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Bentsen

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(54) **SLIDER HAVING INTERIOR RIDGE TO ASSIST ZIPPER OPENING**

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A44B 19/16 (2006.01)

(52) **U.S. Cl.** **24/400**

(58) **Field of Classification Search** ..... 24/30.5 R, 24/399, 30.5 P, 400, 427, DIG. 50, 585.1, 24/585.11, 585.12; 383/63, 64, 68, 69; 53/139.2, 53/133.4, 412; 493/213, 214
See application file for complete search history.

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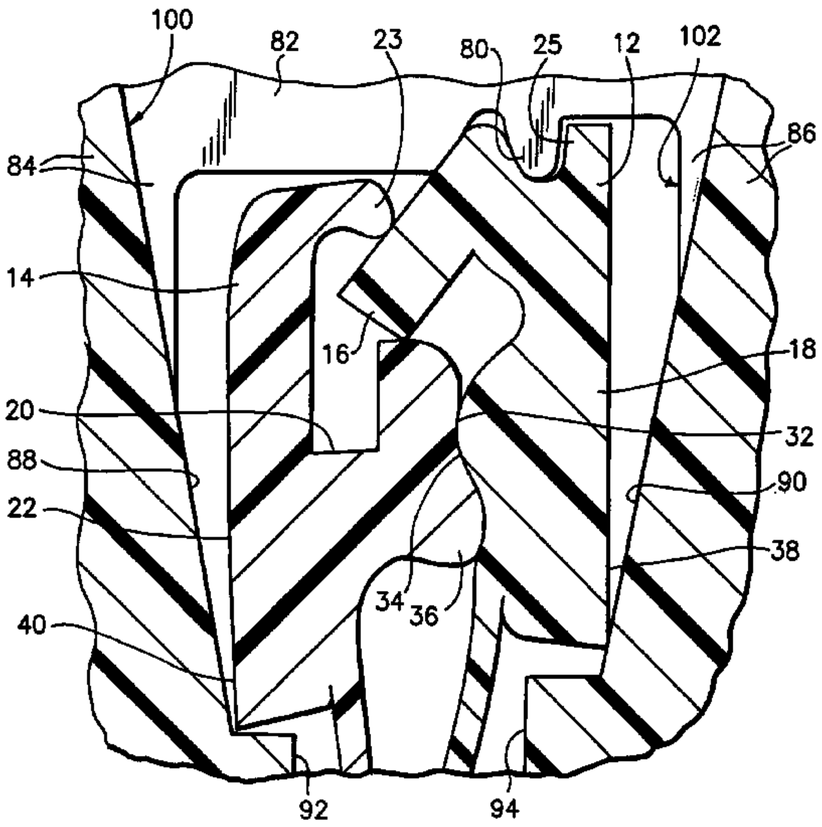
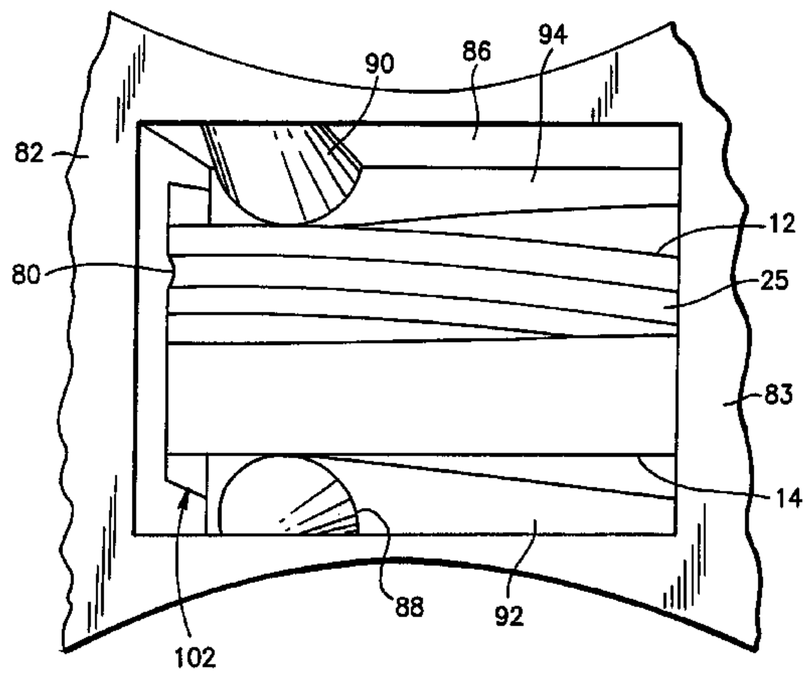
(57) **ABSTRACT**

A slider that reduces the tendency of a slider-zipper assembly to deactivate under freezer conditions. One embodiment of the slider comprises an opening window comprising a top portion, first and second side portions respectively connected to opposing ends of the top portion of the opening window, and a keeper connected to and projecting downward from the top portion, the keeper being disposed closer to the first side portion than to the second side portion of the opening window; a closing window comprising a top portion, and first and second side portions respectively connected to opposing ends of the top portion of the closing window, the closing window being separated from the opening window by a central zone; and a pair of opposing ridges located in the central zone proximal to the opening window and comprising respective convex surface of curving form. The ridges cam the profiled closure members of the zipper together and cam the male-profiled closure member toward the keeper.

24 Claims, 8 Drawing Sheets





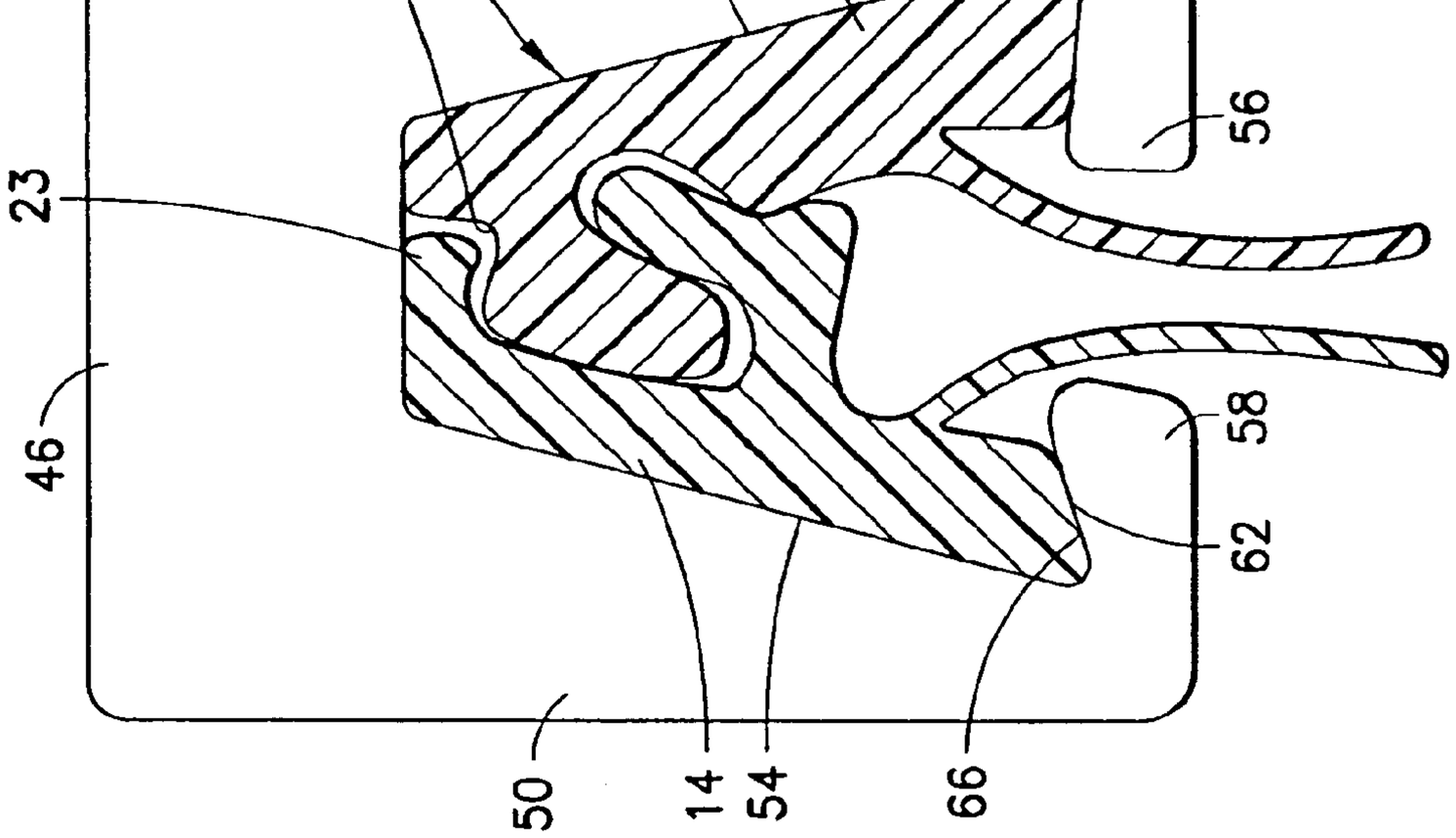


FIG.2
PRIOR ART

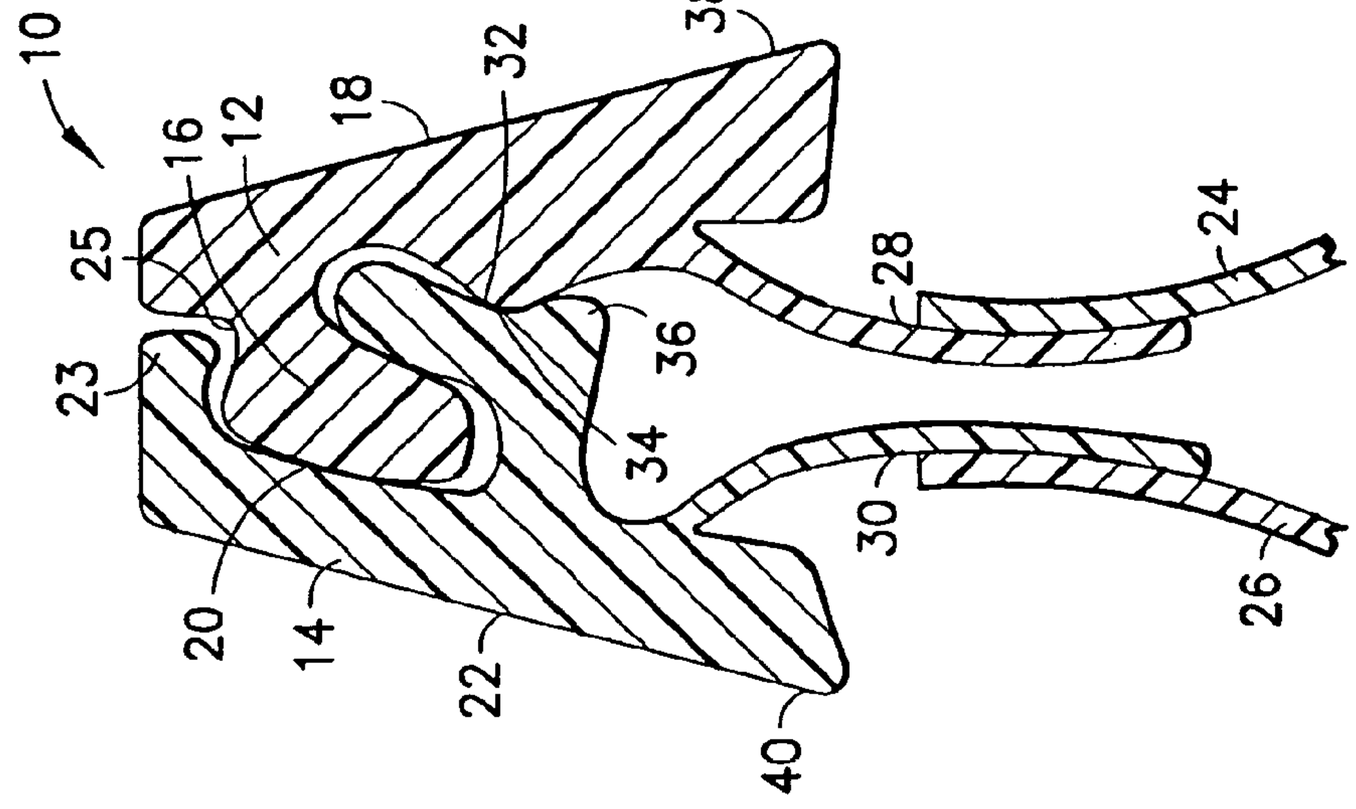


FIG.1
PRIOR ART

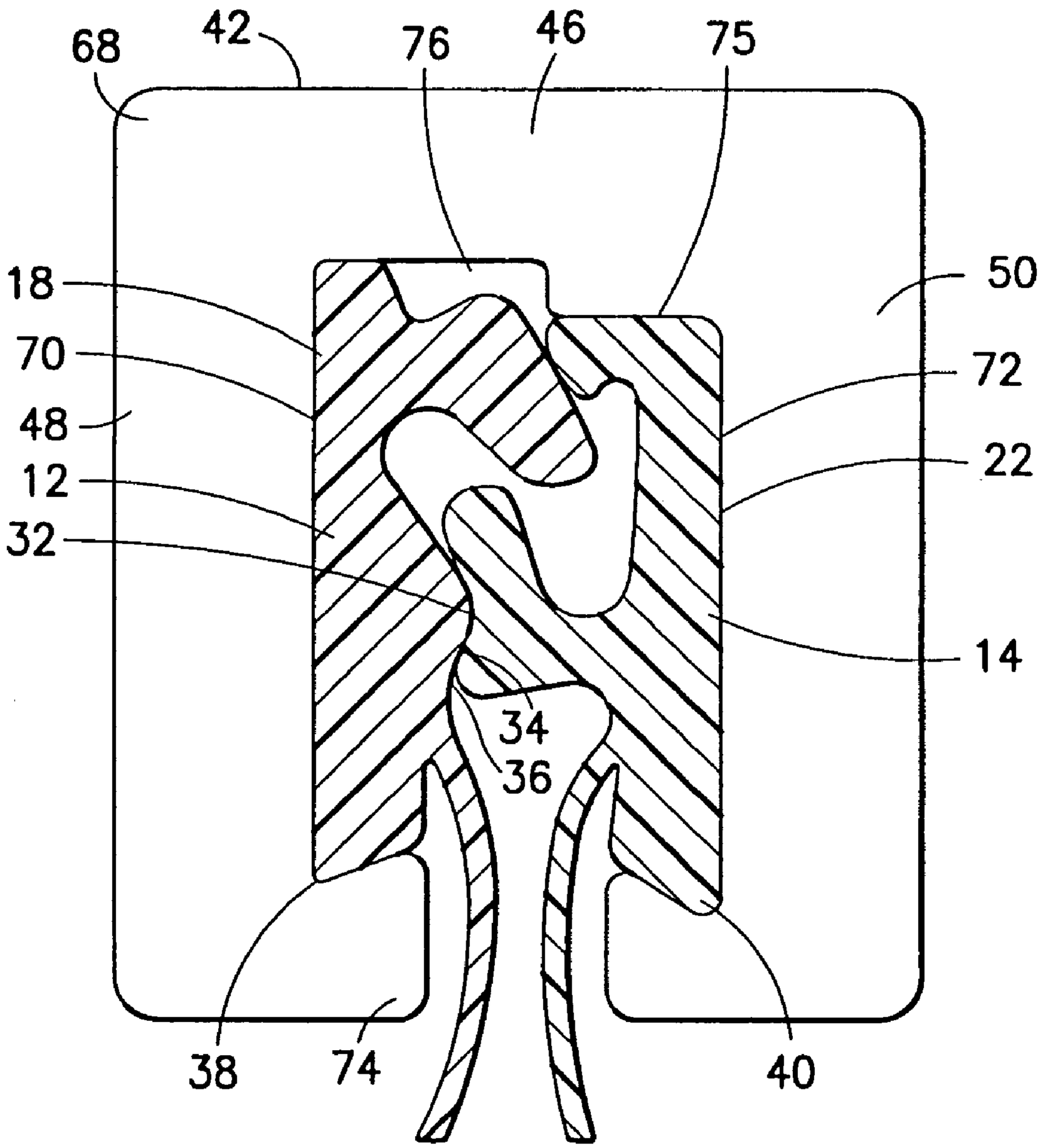


FIG.3
PRIOR ART

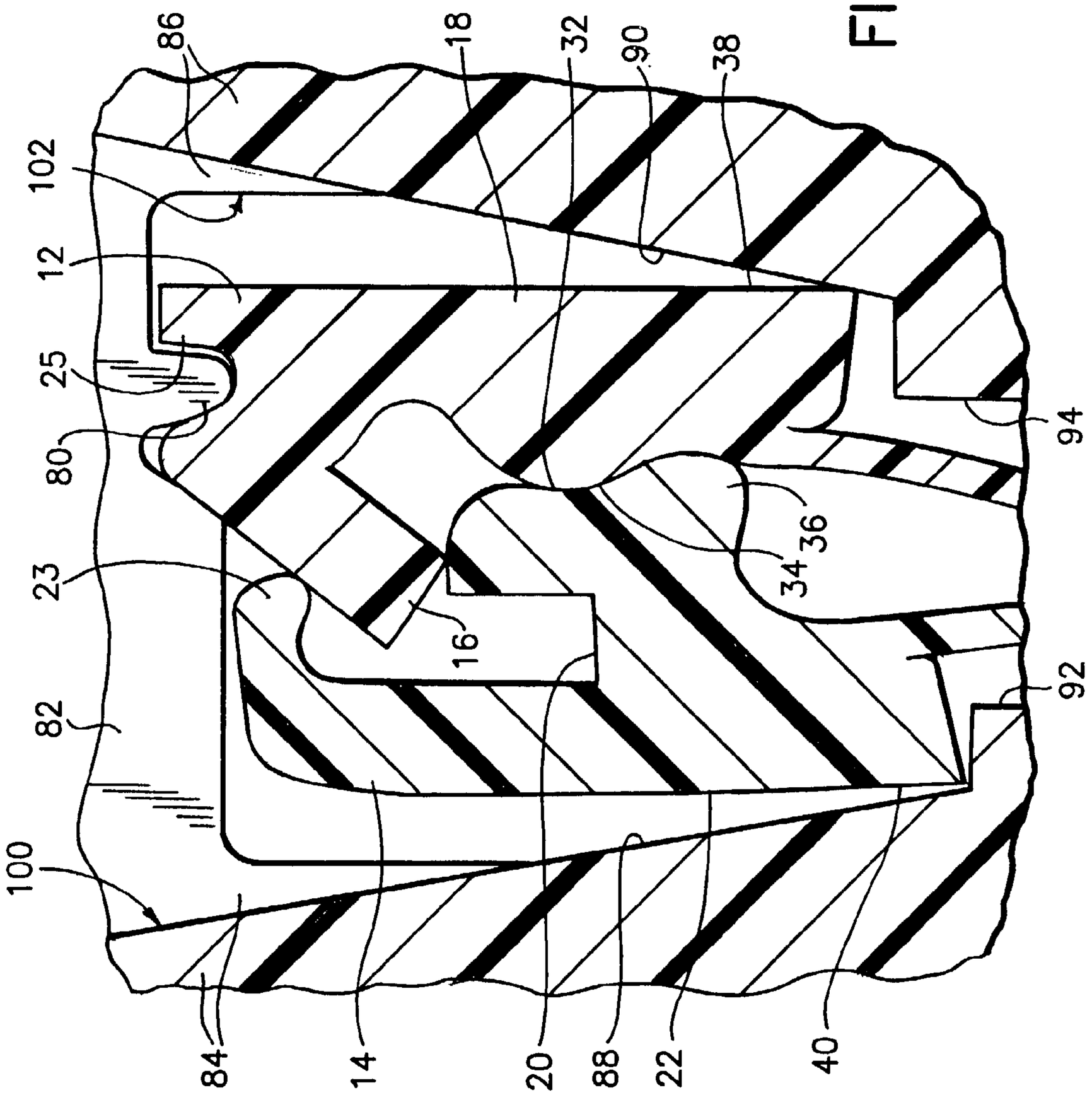


FIG. 4

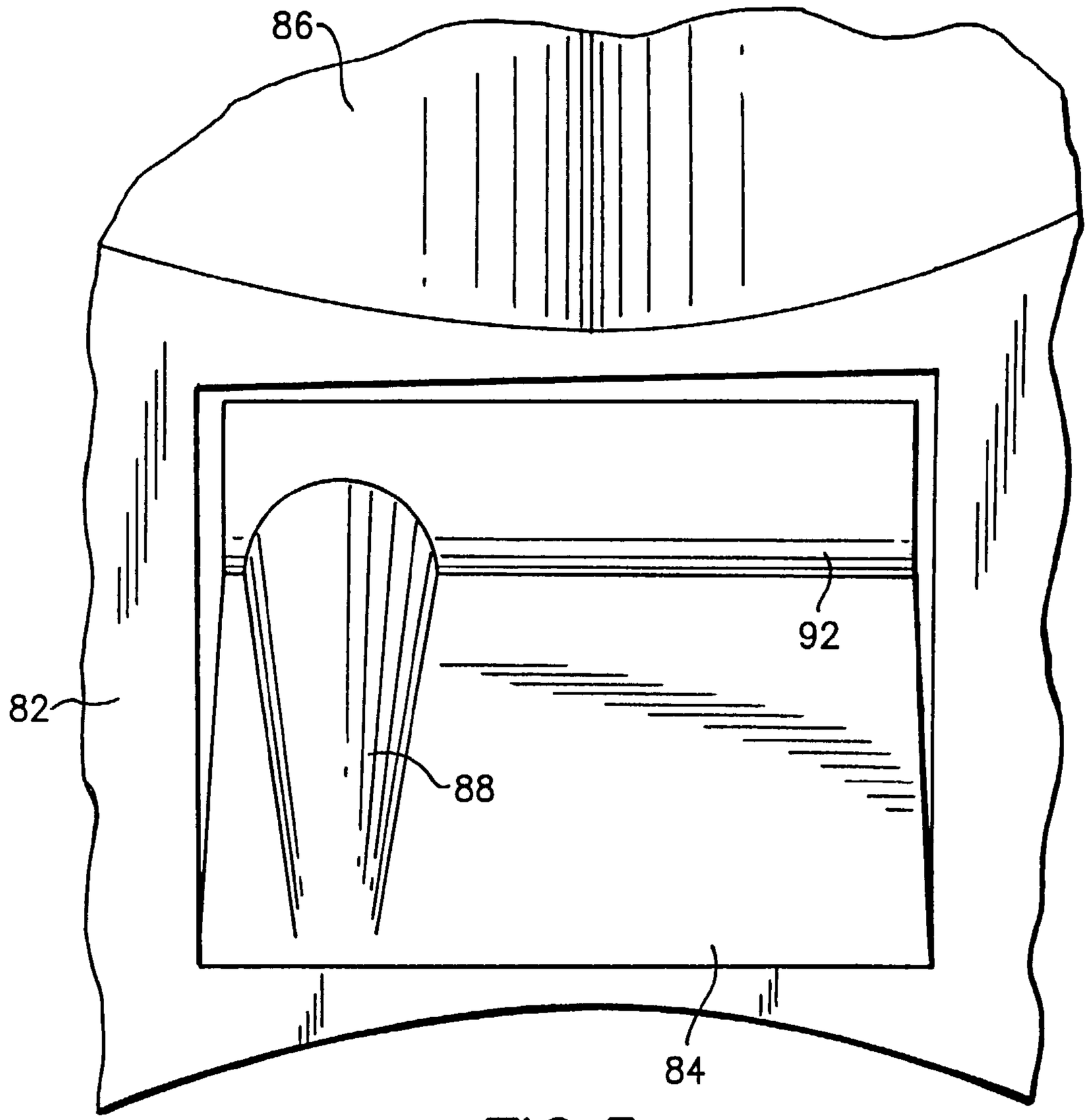
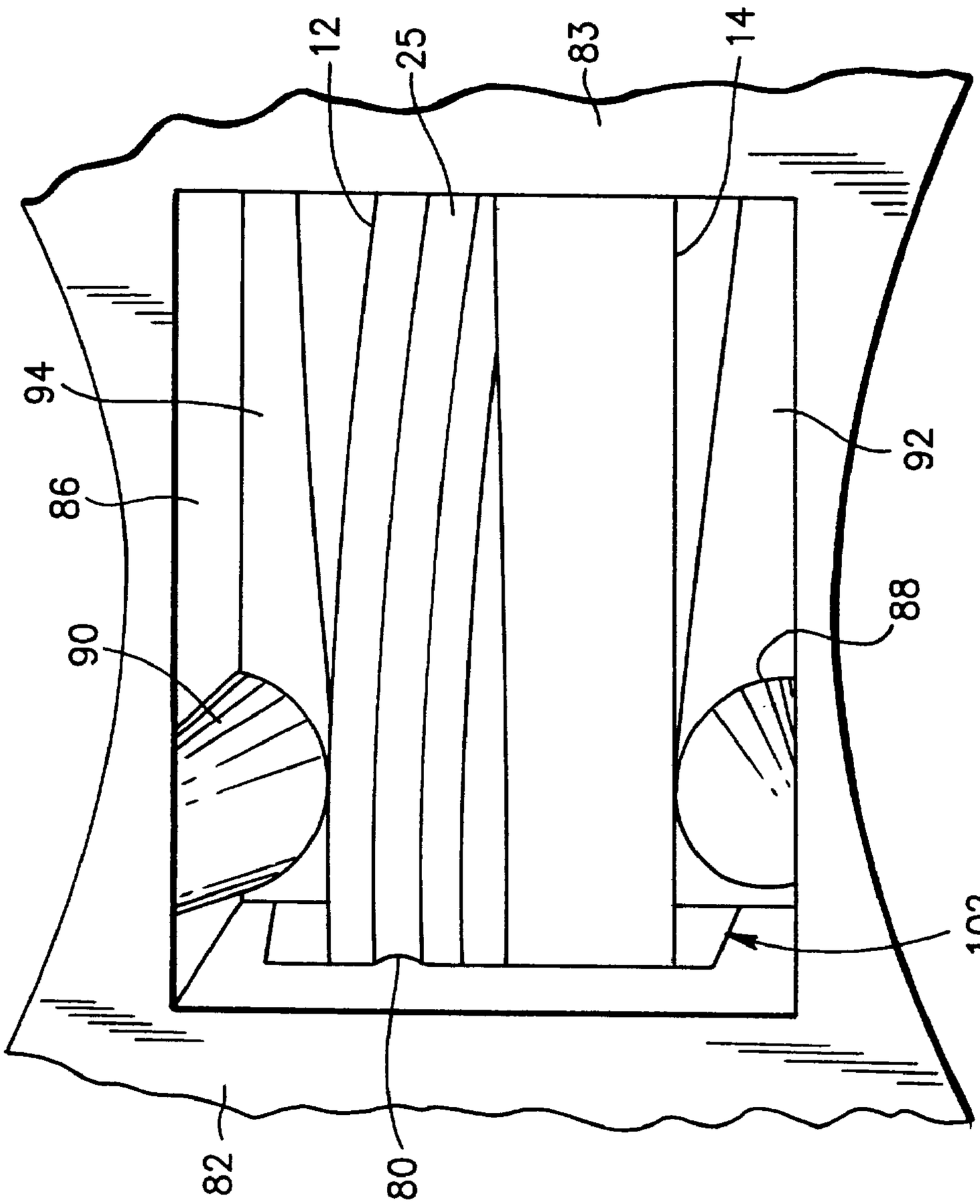


FIG.5

FIG.6



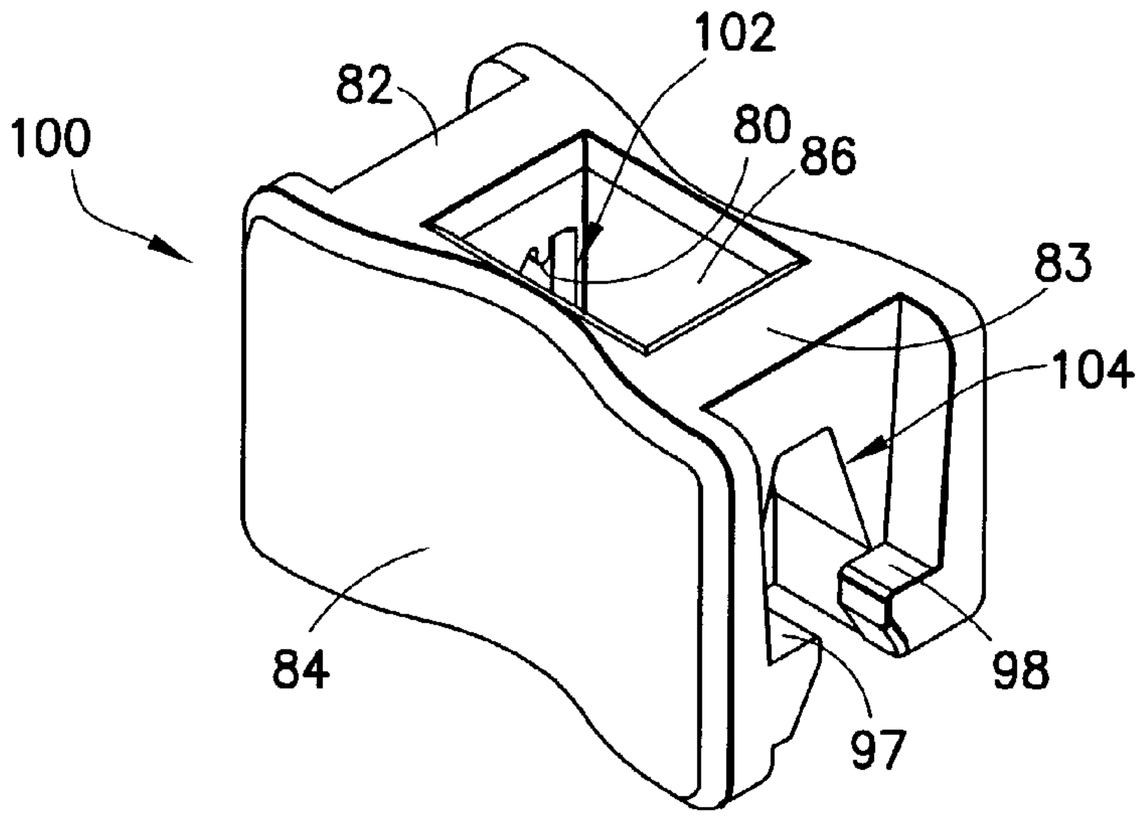


FIG.7

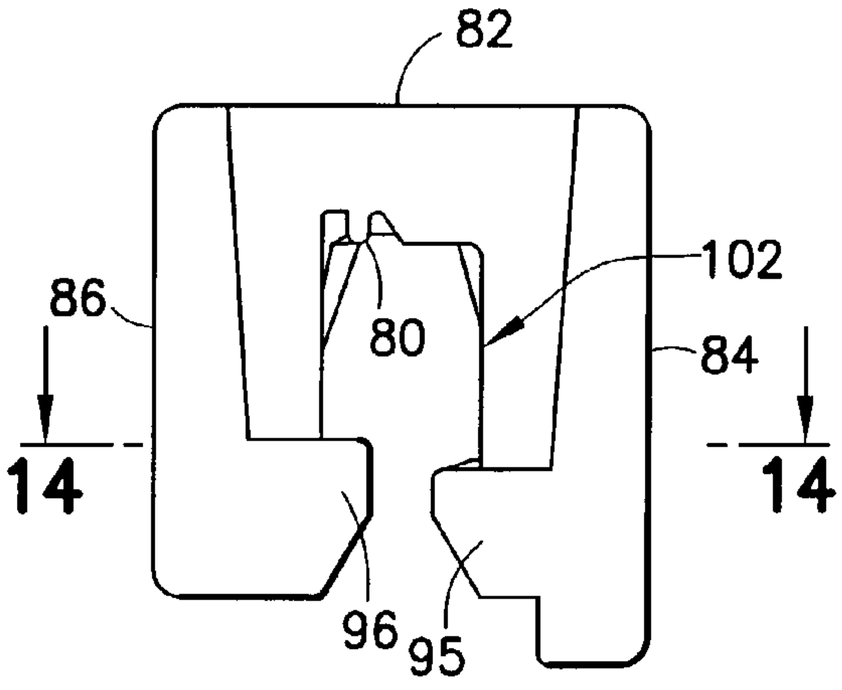


FIG.8

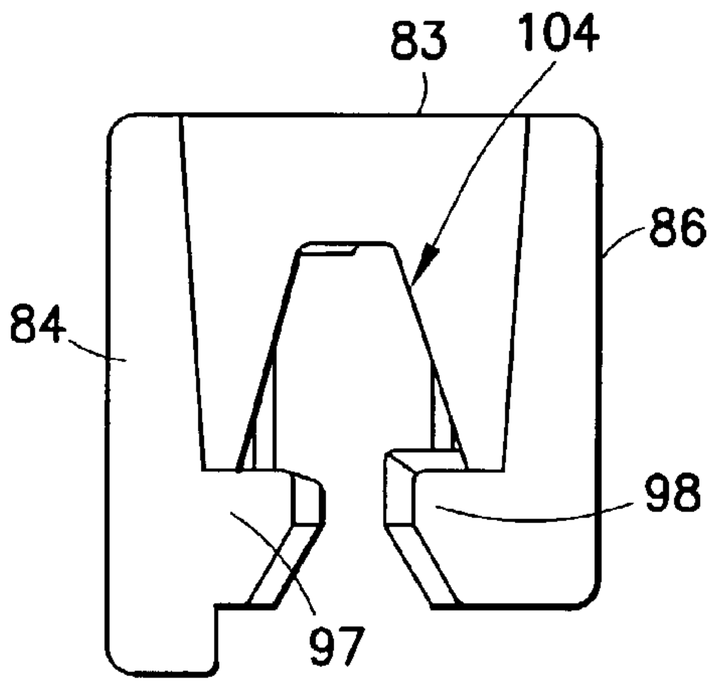


FIG.9

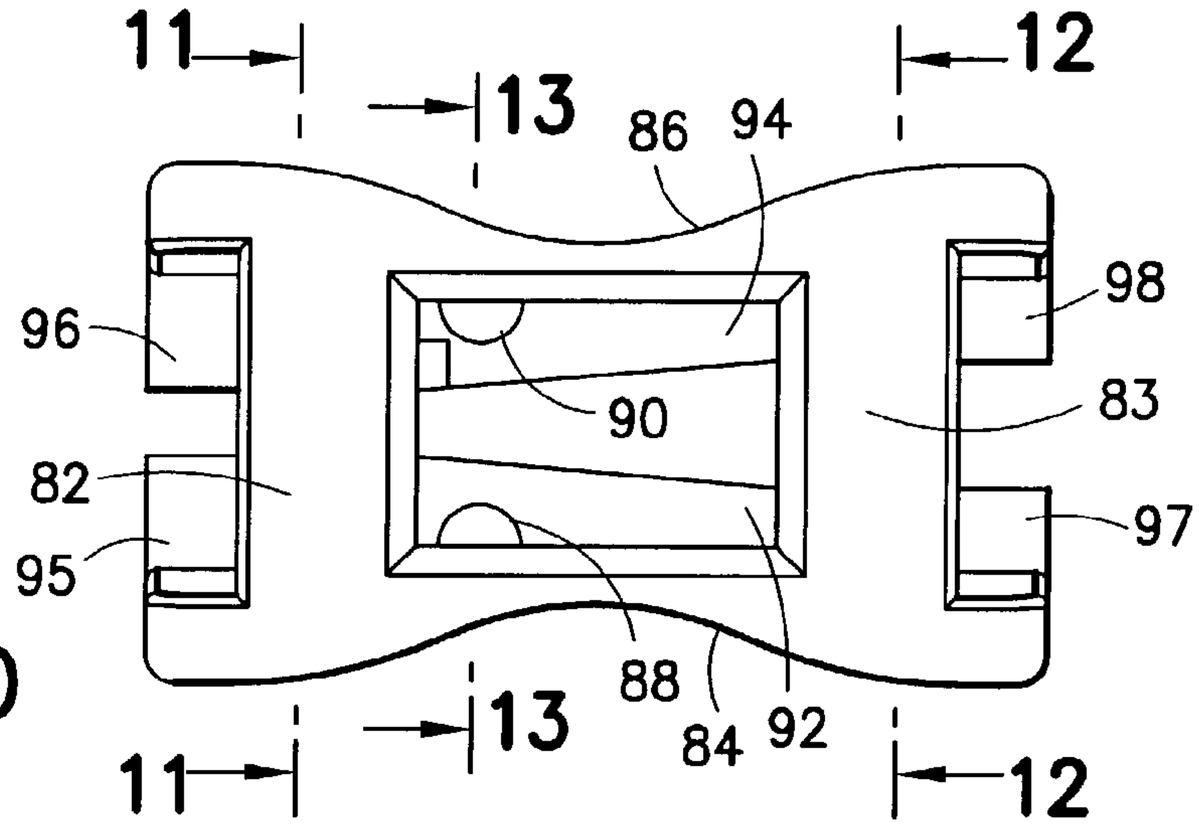


FIG.10

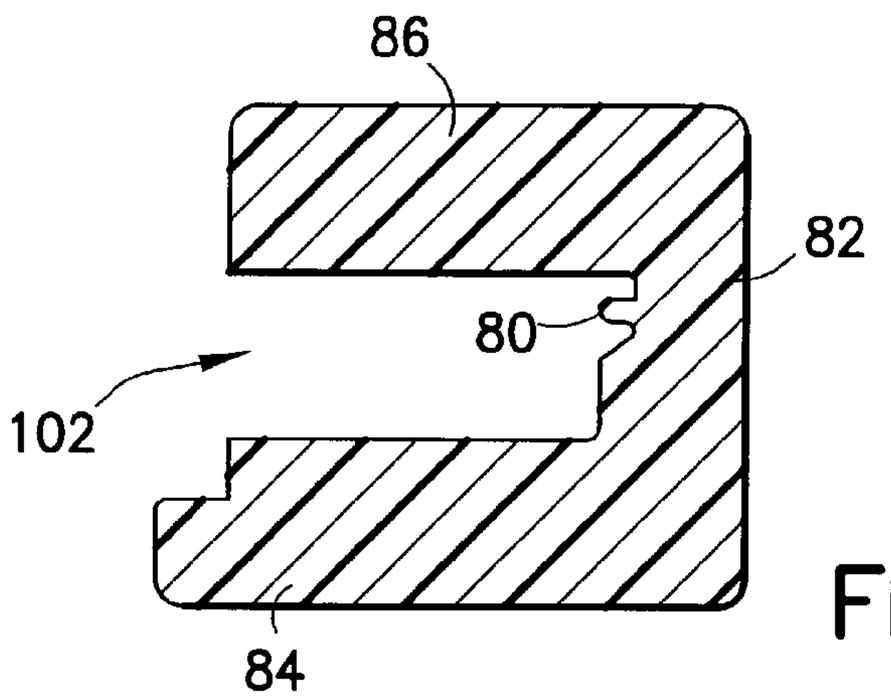


FIG.11

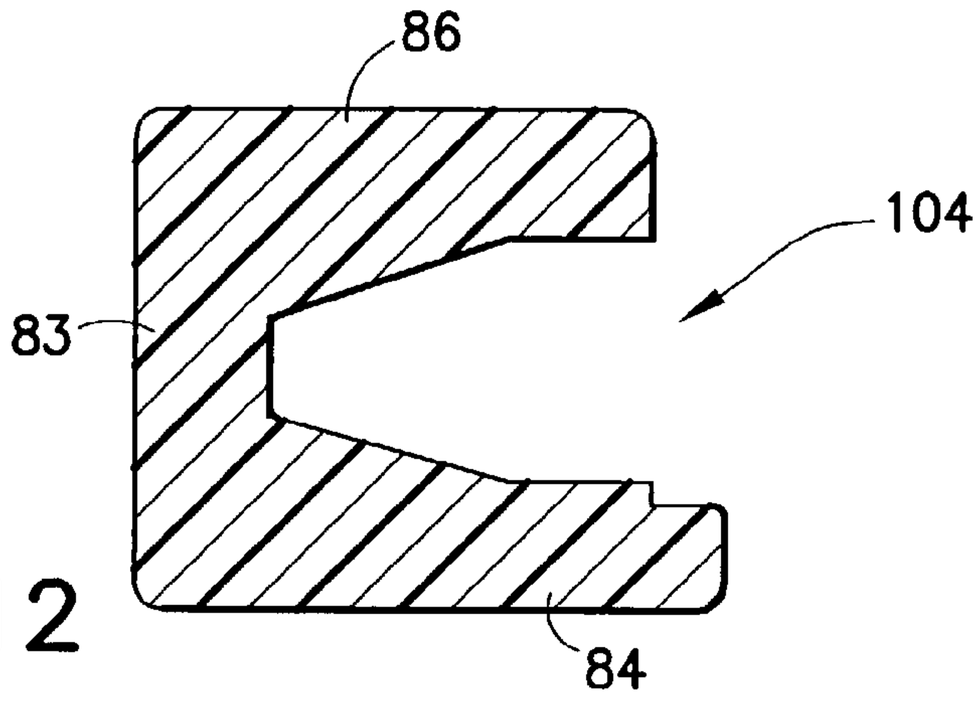


FIG.12

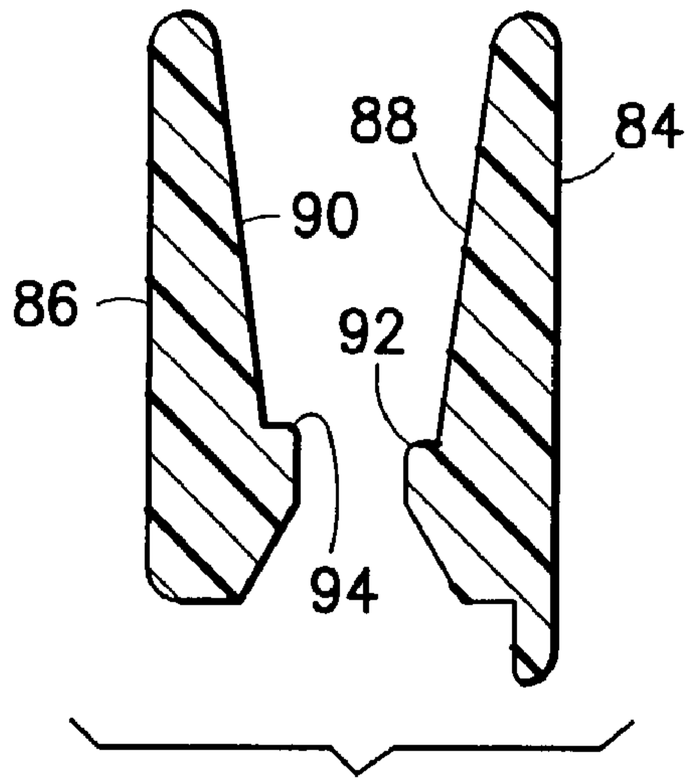


FIG. 13

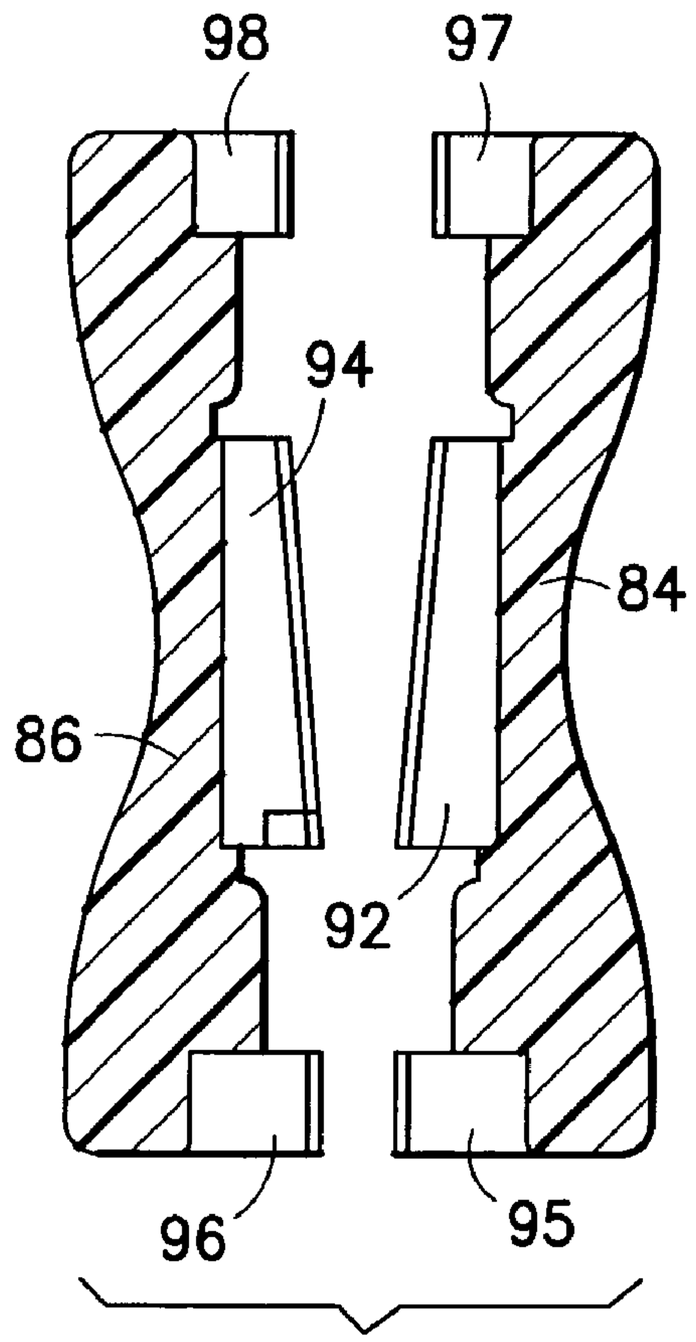


FIG. 14

SLIDER HAVING INTERIOR RIDGE TO ASSIST ZIPPER OPENING

BACKGROUND OF THE INVENTION

This invention generally relates to slider-operated zippers for use in reclosable packaging, such as bags or pouches. In particular, the invention relates to sliders of the type that do not have a separating finger.

Reclosable bags are finding ever-growing acceptance as primary packaging, particularly as packaging for foodstuffs such as cereal, fresh vegetables, snacks and the like. Such bags provide the consumer with the ability to readily store, in a closed, if not sealed, package any unused portion of the packaged product even after the package is initially opened. To gain acceptance as a primary package for foodstuffs, it is virtually mandatory that the package exhibit some form of tamper evidence to protect the consumer and maintain the wholesomeness of the contained product. In addition, in many cases it is necessary that food product be hermetically packaged.

Reclosable fastener assemblies are useful for sealing thermoplastic pouches or bags. Such fastener assemblies typically include a plastic zipper and a plastic slider. Typically, the plastic zippers include a pair of interlockable profiled members that form a closure. As the slider moves across the profiles, the profiles are opened or closed. The profiles in plastic zippers can take on various configurations, e.g. interlocking rib and groove elements having so-called male and female profiles, interlocking alternating hook-shaped closure members, etc. Reclosable bags having slider-operated zippers are generally more desirable to consumers than bags having zippers without sliders because the slider eliminates the need for the consumer to align the interlockable zipper profiles before causing those profiles to engage.

In one type of slider-operated zipper assembly, the slider straddles the zipper and has a separating finger at one end that is inserted between the profiles to force them apart as the slider is moved along the zipper in an opening direction. The other end of the slider is sufficiently narrow to force the profiles into engagement and close the zipper when the slider is moved along the zipper in a closing direction. Other types of slider-operated zipper assemblies avoid the use of a separating finger. For example, U.S. Pat. No. 6,047,450 discloses a zipper comprising a pair of mutually interlockable profiled closure members, portions of which form a fulcrum about which the profiled closure members may be pivoted out of engagement when lower edges of the bases are forced towards each other.

Another known slider of the above-described type has a so-called "keeper" projecting vertically downward from the opening end of the top wall of the slider. The keeper mates with a recess in the male-profiled closure member of the zipper, holding the male-profiled closure member partially away from the female-profiled closure member. By preventing movement of the one closure member towards the other closure member, the zipper profiles always remain at least partially disengaged at the opening end of the slider, thereby reducing the possibility of an unintentional full engagement of the closure members adjacent the opening end or within the slider and facilitating the opening movement of the zipper. In one known slider insertion machine, the zipper tape is "activated" during slider insertion The term "activation" as used herein means that opposing sections of the zipper closure members at the opening end of the slider are at least partially disengaged and held in that state by the keeper. The term "deactivation" as used herein means that the zipper profiles become engaged at the opening end of the slider and are no longer held partly disengaged by the keeper.

The above-described slider-operated zipper, with keeper maintaining the zipper in an activated state, must perform satisfactorily over a wide range of temperatures. In particular, it is desirable that this slider/zipper system perform satisfactorily under freezer temperature conditions, to wit, −5° F. to +5° F. The zipper becomes very stiff at these temperatures. This leads to much higher forces to move the slider back and forth along the zipper. The increased zipper stiffness can also lead to deactivation of the slider/zipper assembly since the recess will not stay on the keeper, which renders the reclosable zipper very difficult to operate, if not non-functional. There is a need for a slider design that reduces the tendency of the slider-zipper assembly to deactivate under freezer conditions.

BRIEF DESCRIPTION OF THE INVENTION

The invention is directed to sliders that reduce the tendency of the slider-zipper assembly to deactivate under freezer conditions; to slider-zipper assemblies incorporating such a slider; and to reclosable packages incorporating slider-zipper assemblies having such a slider.

One aspect of the invention is a slider for opening and closing a plastic zipper, comprising: an opening window having a top portion, first and second side portions respectively connected to opposing ends of the top portion of the opening window, and a keeper connected to and projecting downward from the top portion, the keeper being disposed closer to the first side portion than to the second side portion of the opening window; a closing window comprising a top portion, and first and second side portions respectively connected to opposing ends of the top portion of the closing window, the closing window being separated from the opening window by a central zone; and a ridge located in the central zone proximal to the opening window and comprising a convex surface of curving form.

Another aspect of the invention is a slider for opening and closing a plastic zipper of the type having a fulcrum, comprising: first and second side walls separated by space occupied in part by the zipper; a first beam having one end connected to the first side wall and the other end connected to the second side wall, the first beam and respective first portions of the first and second side walls adjoining the first beam defining an opening window; a second beam one end connected to the first side wall and the other end connected to the second side wall, the second beam and respective second portions of the first and second side walls adjoining the second beam defining a closing window; first and second tabs respectively projecting from the first and second side walls and toward each other for retaining the slider on the zipper; and a ridge projecting from the first side wall proximal to the opening window and comprising a convex surface of curving form.

Yet another aspect of the invention is a slider for use on a zipper of the type comprising a first profiled interlockable member and a second profiled interlockable member adapted to interlock with the first interlockable member, the slider comprising: a pair of spaced apart arms defining at opposite ends of the arms a zipper opening end of the slider that disengages adjoining first portions of the first and second interlockable members and a zipper closing end of the slider that interlocks adjoining second portions of the first and second interlockable members; bridge means that span a gap between the arms, the bridge means being

connected to top portions of the arms; means for keeping the first portion of the first interlockable member at least partially disengaged from the first portion of the second interlockable member in the zipper opening end; means for camming the first portion of the first interlockable member upward toward the keeping means when the slider is moved in a zipper opening direction; and means for retaining the slider on the zipper.

Another aspect of the invention is an assembly comprising a pair of interlockable profiled closure members and a slider mounted to the profiled closure members and movable in either a first direction to cause the profiled closure members to interlock with each other or in a second direction to cause the profiled closure members to disengage from each other, wherein the slider is as described in any of the three preceding paragraphs.

A further aspect of the invention is a slider-zipper assembly comprising: first and second interlockable profiled closure members each having a respective substantially constant profile along its length, the first profiled closure member comprising a recess that does not engage the second profiled closure member; and a slider mounted to the first and second profiled closure members and movable in either a first direction to cause the profiled closure members to interlock with each other or in a second direction to cause the profiled closure members to disengage from each other, wherein the slider comprises a closing section that is penetrated by respective first portions of the first and second profiled closure members, the closing end being configured such that the first portions of the first and second profiled closure members can penetrate the closing end only if the first portions are interlocked; an opening section penetrated by respective second portions of the first and second profiled closure members, the opening end being configured such that the second portions of the first and second profiled closure members can penetrate the opening end when the second portions are not interlocked, the opening section comprising a keeper that engages the recess in the first profiled closure member; and a central section connecting the opening section to the closing section, the central section comprising a ridge proximal to the opening section, the ridge comprising a convex surface of curving form having a shape designed to maintain the recess of the second portion of the first profiled closure member in engagement with the keeper when the slider is traveling in the second direction.

Another aspect of the invention is a slider-zipper assembly comprising: first and second interlockable profiled closure members each having a respective substantially constant profile along its length, the first profiled closure member comprising a recess that does not engage the second profiled closure member; and a slider mounted to the first and second profiled closure members and movable in either a first direction to cause the profiled closure members to interlock with each other or in a second direction to cause the profiled closure members to disengage from each other, wherein the slider comprises: a closing section penetrated by respective first portions of the first and second profiled closure members, the closing end being configured such that the first portions of the first and second profiled closure members can penetrate the closing end only when the first portions are interlocked; an opening section penetrated by respective second portions of the first and second profiled closure members, the opening end being configured such that the second portions of the first and second profiled closure members can penetrate the opening end when the second portions are not interlocked, the opening section comprising a keeper shaped and positioned to engage the recess in the first profiled closure member; and a central section connecting the opening section to the closing section, the central section comprising first and second ridges proximal to the opening section, the first and second ridges respectively comprising first and second convex surfaces of curving form having respective shapes designed to maintain the recess of the second portion of the first profiled closure member in engagement with the keeper when the slider is traveling in the second direction.

Yet another aspect of the invention is an assembly comprising a zipper and a slider mounted to the zipper and movable in opening and closing directions along the zipper, the zipper comprising first and second interlockable profiled closure members relatively rotatable about a fulcrum to transition from an interlocked state to an at least partially disengaged state within the slider, the first closure member comprising a recess not engageable with the second closure member, and the slider comprising: opposing curved surfaces that contact the first and second closure members during slider travel in the opening direction with respective orientations such that respective lower portions of the first and second closure members are pushed together and deflected upward, the pressing together causing the respective portions of the first and second closure members to rotate about the fulcrum and transition from the interlocked state to an at least partially disengaged state within the slider; a keeper that engages the recess in the deflected upward portion of the first closure member to a degree sufficient to maintain the first closure member in an at least partially disengaged state within the slider; and means for retaining the slider on the zipper.

A further aspect of the invention is a reclosable package comprising: a receptacle having a mouth; and a slider-zipper assembly joined to the receptacle in a manner such that the mouth is closed when the profiled closure members are interlocked with each other and the mouth is open when the profiled closure members are disengaged from each other, the slider-zipper assembly being as described in any of the preceding four paragraphs.

Other aspects of the invention are disclosed and claimed below.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a drawing showing a sectional view of a closed zipper of a known type.

FIG. **2** is a drawing showing a sectional view of the same zipper as presented in FIG. **1**, with a slider mounted thereto. The closing end of the slider is shown.

FIG. **3** is a drawing showing a sectional view of the same zipper as presented in FIG. **1**, with a slider mounted thereto. The opening end of the slider is shown.

FIG. **4** is a drawing showing a sectional view of portions of a slider-zipper assembly in accordance with one embodiment of the present invention. The opening end of the slider is shown.

FIG. **5** is a drawing showing a perspective view of portions of the slider in accordance with the disclosed embodiment of the invention. The view is taken through the top of the slider, but at an oblique angle to one side of the slider.

FIG. **6** is a drawing showing a perspective view of portions of the slider-zipper assembly in accordance with the disclosed embodiment of the invention. Again the view is taken through the top of the slider, but at an oblique angle looking from one end of the slider.

FIG. **7** is a drawing showing an isometric view of the slider in accordance with the disclosed embodiment of the invention.

FIGS. **8** and **9** are drawings showing opening end and closing end views, respectively, of the slider depicted in FIG. **7**.

FIG. **10** is a drawing showing a top view of the slider depicted in FIG. **7**.

FIGS. **11–13** are drawings showing sectional views of the slider depicted in FIG. **7**. The sections are respectively taken along lines **11—11**, **12—12**, and **13—13** indicated in FIG. **10**.

FIG. **14** is a drawing showing sectional view of the slider depicted in FIG. **7**, the section being taken along line **14—14** indicated in FIG. **8**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The disclosed embodiment of the present invention has some similarity to the known slider-zipper assembly depicted in FIGS. **1–3**.

FIG. **1** shows a cross-sectional view of a known plastic zipper **10**. The zipper **10** is preferably formed of a resilient plastic material, such as polyethylene, and comprises a first profiled closure member **12** and a second profiled closure member **14**. The first closure member **12** comprises a male member **16** designed to interlock with the second closure member **14** and a relatively stiff base **18**. Similarly, the second closure member **14** comprises a female member **20** designed to interlock with the male member **16** of the first closure member **12** and a relatively stiff base **22**. The zipper **10** further comprises extensions or flanges **28** and **30**. One end of flange **28** is connected to base **18**, while one end of the other flange **30** is connected to base **22**.

The zipper **10** can be sealed to the mouth of a receptacle in a well-known manner to form a reclosable bag. In particular, as shown in FIG. **1**, flange **28** is permanently sealed (e.g., by conduction heat sealing) to one wall **24** of the receptacle, while flange **30** is permanently sealed to the other wall **26** of the receptacle. In one type of bag, the wall **24** and **26** are integrally connected at a fold line situated at the bottom of the bag. Although not shown in FIG. **1**, the walls **24** and **26** are also joined at the sides of the package, at least from the bottom to the slider end stops on the zipper, by respective side seals. The bag walls **24** and **26** are formed of a suitable plastic film material for the product to be contained within the package.

Instead of dual flanges of substantially equal length, the zipper flanges can be unequal in length. Alternatively, the zipper flanges could be connected at their distal ends with a line of reduced tear resistance running along the cusp. In accordance with a further alternative, the zipper profiles could be connected by a continuous membrane which is cut on one side to form split flanges, one being longer than the other, and the long flange being sealed to both walls of the receptacle and having a tear line therein. In a further alternative, the zipper and bag making film could be extruded as one piece.

As is clear from FIG. **1**, the outer surface of the bases **18** and **22** are not parallel, but diverge downwardly to form a shape that resembles the letter "A". Because of this "A" configuration, the zipper is difficult to open from the contents (i.e., product) side of the receptacle since the opening force tends to push the lower extremities of the profiled closure members apart, thereby enhancing the interlock between the male member **16** and the female member **20**.

The male profiled closure member **12** also includes a convex fulcrum member **32** which engages a concave fulcrum member **34** of the female profiled closure member **14** to form a fulcrum **36**, as shown in FIG. **1**. The fulcrum **36** is not equidistant between the bases **18** and **22**, but rather is offset closer to the closure member **12**. The surfaces of the fulcrum members **32** and **34** are contoured to form a seal between the interlocked closure members **12** and **14** at the fulcrum **36**.

When the distal edges **38** and **40** of the bases **18** and **22**, respectively, are forced towards each other, the resulting leverage causes the closure members **12** and **14** to pivot oppositely about the fulcrum **36** and disengage from each other, as shown in FIG. **3**. The male member **16** is shaped to readily permit easy disengagement from the female member **20**. A top latch **23** on the female member **20** is resiliently releasable from the top cavity or indent **25** in the male member **16** to permit opening upon a force being applied to the latch **23** by an upper shoulder **75** (see FIG. **3**) on an associated slider, as will be described in greater detail below. To ensure proper pivoting of the closure members **12** and **14**, the bases **18** and **22** should be more rigid than the male and female members **16** and **20**. This may be achieved, for example, by making the bases **18** and **22** thicker than the resilient portions of members **16** and **20**.

To facilitate opening and closing of the zipper **10**, the zipper **10** is provided with a straddling slider **42**, as shown in FIG. **2**. The slider **42** can be top-loaded onto the zipper without having to disengage the profiled closure members at the loading point since the slider does not make use of a separating finger. The slider is slidable along the zipper in either a closing direction or an opening direction opposite to the closing direction. The closure members **12** and **14** are fully engaged, i.e., interlocked, with each other as the slider travels in the closing direction. The closure members **12** and **14** are disengaged from each other as the slider travels in the opening direction. The slider **42** is preferably made of a resilient plastic material, such as delrin, polypropylene, PBT, etc.

FIG. **2** depicts a closing end **44** of the slider **42**, with the zipper **10** shown in cross section. The closing end is shaped to force the closure members **12** and **14** into engagement when the slider **42** travels in the closing direction. The closing end **44** is so-called because it is the end where the zipper closure members **12**, **14** are forced into engagement when the slider **40** is moved in the closing direction, i.e., opposite to the closing end **44**. During slider travel in the closing direction, the closing end is the trailing end of the slider.

As shown in FIG. **2**, the slider **42** straddles the zipper **10** and has a top **46** from which a first arm **48** and a second arm **50** depend. The first arm **48** has an inner surface **52** and the second arm **50** has an inner surface **54**. The slider inner surfaces **52** and **54** are divergent with respect to each other in the same manner as the zipper bases **18** and **22**, and are spaced to push the closure members **12** and **14** into engagement as the slider **42** is moved along the zipper **10** in the closing direction. The slider arms **48** and **50** are respectively provided with retaining shoulders **56** and **58** having upper surfaces **60** and **62** which mate with lower surfaces **64** and **66** of the closure members **12** and **14**. The surfaces **60**, **62**, **64**, and **66** may be tapered to maximize their pull-off resistance. The mating of these surfaces, in combination with the "A" configuration of the profiled members **12**, **14**, prevents the slider **42** from being inadvertently pulled off the zipper **10** during use, since an upward pulling motion will

tend to pull the profile bases **18**, **22** apart at their distal ends **38**, **40**, thereby locking the slider **42** onto the zipper **10**.

Opening of the zipper **10** is achieved when the slider **42** is moved in the opening direction. As shown in FIG. **3** (which views the slider from the side opposite to that seen in FIG. **2**), at the opening end **68** of the slider, the slider arms have inner surfaces **70** and **72** which are substantially parallel, rather than divergent as at the closing end **44** (shown in FIG. **2**). Additionally, the first slider arm **48** has a retaining shoulder **74** (as shown in FIG. **3**) that is thicker than retaining shoulder **56** at the closing end **44** (as shown in FIG. **2**), and a shoulder **75** extending downwardly from the slider top portion **46**.

As the slider is moved in the opening direction and the slider arm inner surfaces change from the "A" configuration (or trapezoidal window) of surfaces **52** and **54** (see FIG. **2**) to the substantially parallel configuration (or rectangular window) of surfaces **70** and **72** (see FIG. **3**), the distal edges **38** and **40** of the profile bases **18** and **22** are forced towards each other, thereby forcing the fulcrum members into a tighter relationship and causing the closure members **12** and **14** to pivot oppositely about the fulcrum **36**. Simultaneously, the retaining shoulder **74** on slider arm **48** forces the male profile **12** upward, while shoulder **75** holds the female profile **14** in place, thereby causing the convex male fulcrum member **32** to cam upwardly along the concave female fulcrum member **34**. Thus, as is shown in FIG. **3**, the resulting action is a simultaneous pivoting of the closure members **12** and **14** oppositely about the fulcrum **36** and an upward translation of closure member **12** relative to closure member **14**, resulting in disengagement of the profiled closure members, as shown in FIG. **3**. A cavity **76** in the slider top accommodates the upward translation of the male profiled closure member **12**.

One embodiment of the present invention will now be described with reference to FIGS. **4**–**14**. FIGS. **4** and **6** show portions of that slider mounted to a zipper. The same reference numerals will be used to designate elements of the zipper as were used in FIG. **1**. FIG. **5** depicts portions of the slider not mounted to a zipper. FIGS. **7**–**14** show different views of the slider.

FIGS. **7** and **10** show the structure of the slider. The slider comprises a pair of arms **84** and **86** separated by a gap, a first transverse top beam **82** having one end connected to arm **84** and the other end connected to arm **86**, and a second transverse top beam **83** having one end connected to arm **84** and the other end connected to arm **86**. The arms and beams are integrally formed, e.g., by injection molding of the slider. The beam **82** and adjoining portions of the arms or side walls **84** and **86** define an opening window **102** (best seen in FIG. **11**); the beam **83** and adjoining portions of the arms or side walls **84** and **86** define a closing window **104** (best seen in FIG. **12**). As seen in FIG. **11**, the opening window **102** has a generally rectangular shape; as seen in FIG. **12**, the closing window **104** has a generally trapezoidal shape.

The slider is retained on the zipper by respective sets of opposing retaining tabs projecting inward from the arms **84** and **86**. As best seen in FIG. **14**, a pair of long retaining tabs **92** and **94** extend generally longitudinally in a central section of the slider, the central section lying between the opening and closing windows; a pair of short retaining tabs **95** and **96** are disposed on the other side of the opening window; and a pair of short retaining tabs **97** and **98** are disposed on the other side of the closing window. The tab **94** ramps linearly upward as it approaches the opening window **102**. As seen in FIG. **9**, the corners of the tabs **97** and **98** are chamfered. Tabs **92**, **95** and **97** are each integrally formed with arm **84**; tabs **94**, **96** and **98** are each integrally formed with arm **86**.

The slider further comprises a pair of opposing convex curved surfaces (i.e., ridges) **88** and **90**. In the disclosed embodiment, ridges **88** and **90** are integrally formed with and project from the arms **84** and **86**, respectively, of slider **100**. The shape of ridges **88** and **90** is best seen in FIG. **5** and **6**. In the disclosed embodiment, each ridge is generally conical in shape. However, other convex surfaces of curving form can be used and the invention is not limited to camming ridges or surfaces having a conical shape. The base of ridge **88** is connected to and to integrally formed with retaining tab **92**, while the base of ridge **90** is connected to and integrally formed with retaining tab **94**. Each ridge tapers upward in a direction generally transverse to the respective central retaining tab.

As seen in FIG. **6**, the ridges **88** and **90** are located proximal to the opening window **102** in opposition to each other. These opposing curved surfaces contact the closure members **12** and **14** during slider travel in the opening direction. As seen in FIGS. **4** and **13**, the crests of the ridges **88** and **90** diverge in the upward direction. As the slider travels in the opening direction, the respective adjoining portions of closure members **12** and **14** are pushed together and deflected upward. This pressing together causes the respective portions of closure members to rotate about the above-described fulcrum and transition from an interlocked or closed state to an at least partially disengaged or opened state. The partially disengaged closure members **12** and **14** can be seen through the opening in the top of the slider shown in FIG. **6**.

FIG. **4** shows a sectional view taken facing the opening end of the slider, with closure members **12** and **14** of the zipper in the at least partially disengaged state. The section is taken in a plane that is generally located, relative to the slider, along the line designated **13**—**13** in FIG. **10**. As seen in FIG. **4**, the slider comprises a keeper **80** extending downward from the first top beam **82** and disposed between arms or side walls **84** and **86**. In the state depicted in FIG. **4**, the keeper **80** secures the closure member **12** to prevent it from moving toward the mating closure member **14**. The closure member **12** includes a recess **25** to accommodate the keeper **80**. By preventing movement of the closure member **12** towards the closure member **14**, the closure members remain at least partially disengaged at the opening end, thereby reducing the possibility of an unintentional full engagement of the closure members adjacent the opening end or within the slider. The closure member **12** of the zipper has been cammed upward by the crest of ridge **90** until the keeper **80** is nestled snugly in the recess **25** formed in the top of the profile of closure member **12**. Similarly, the ridge **88** on the opposite side of the slider cams the closure member **14** toward the closure member **12**. Thus the ridges **88** and **90** serve to increase the force exerted by the slider on the zipper profiles, thereby increasing its effectiveness in opening the zipper, as well as reducing the load on the keeper and providing a more positive opening. The result is a slider-zipper assembly that will not deactivate at freezer temperatures absent unusual circumstances, while also working well at warmer temperatures.

It is known to apply a slider-operated zipper to a web of bag making film as the film is being advanced toward a form-fill-seal (FFS) machine. In one known system, a zipper tape is unwound from a spool and advanced to a device for forming slider end stops, e.g., by crushing or ultrasonic stomping. The stomped zipper tape is then advanced to a

slider insertion device, which inserts a respective slider on each increment of zipper corresponding to the length of the zipper in the reclosable package. In the case of the slider-zipper assembly depicted in FIG. **4**, the slider insertion device both inserts a slider on the zipper tape and simultaneously activates a section of the zipper tape at the opening end of the inserted slider.

The disclosed embodiment has discontinuous slider arm inner surfaces (i.e., opening and closing windows **102** and **104**) and discontinuous retaining tabs **92** and **94**–**98**, with a large chamber provided in a central section between the opening and closing windows. However, the slider arm inner surfaces that act on the zipper and the retaining shoulders or tabs that retain the slider on the zipper may be continuous along the length of the slider.

While the invention has been described with reference to preferred embodiments, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for members thereof without departing from the scope of the invention. In addition, many modifications may be made to adapt a particular situation to the teachings of the invention without departing from the essential scope thereof. Therefore it is intended that the invention not be limited to the particular embodiment disclosed as the best mode contemplated for carrying out this invention, but that the invention will include all embodiments falling within the scope of the appended claims.

What is claimed is:

1. A slider for opening and closing a plastic zipper, comprising:

an opening window comprising a top portion, first and second side portions respectively connected to opposing ends of said top portion of said opening window, and a keeper connected to and projecting downward from said top portion, said keeper being disposed closer to said first side portion than to said second side portion of said opening window;

a closing window comprising a top portion, and first and second side portions respectively connected to opposing ends of said top portion of said closing window, said closing window being separated from said opening window by a central connecting zone; and

a first ridge located in said central zone proximal to said opening window and comprising a first convex surface of curving form,

wherein said first convex surface of curving form is tapered upward.

2. The slider as recited in claim **1**, wherein said top portion and said first and second side portions of said opening window bound a generally rectangular space, and said top portion and said first and second side portions of said closing window bound a generally trapezoidal space.

3. The slider as recited in claim **1**, further comprising a tab located in said central zone, wherein said tab ramps upward as it approaches said opening window.

4. The slider as recited in claim **1**, further comprising first and second side walls disposed on opposing sides of said slider, said first side wall connecting said first side portion of said opening window to said first side portion of said closing window, and said second side wall connecting said second side portion of said opening window to said second side portion of said closing window, where in said first ridge is connected to said first side wall.

5. The slider as recited in claim **4**, wherein said first and second side walls, said opening and closing windows, and said first ridge are integrally formed as parts of a monolithic molded body.

6. A slider for opening and closing a plastic zipper, comprising:

an opening window comprising a top portion, first and second side portions respectively connected to opposing ends of said top portion of said opening window, and a keeper connected to and projecting downward from said top portion, said keeper being disposed closer to said first side portion than to said second side portion of said opening window;

a closing window comprising a top portion, and first and second side portions respectively connected to opposing ends of said top portion of said closing window, said closing window being separated from said opening window by a central connecting zone; and

a first ridge located in said central zone proximal to said opening window and comprising a first convex surface of curving form,

wherein said first convex surface of curving form is generally conical.

7. The slider as recited in claim **6**, wherein said top portion and said first and second side portions of said opening window bound a generally rectangular space, and said top portion and said first and second side portions of said closing window bound a generally trapezoidal space.

8. The slider as recited in claim **6**, further comprising a tab located in said central zone, wherein said tab ramps upward as it approaches said opening window.

9. The slider as recited in claim **6**, further comprising first and second side walls disposed on opposing sides of said slider, said first side wall connecting said first side portion of said opening window to said first side portion of said closing window, and said second side wall connecting said second side portion of said opening window to said second side portion of said closing window, wherein said first ridge is connected to said first side wall.

10. A slider for opening and closing a plastic zipper, comprising:

an opening window comprising a top poraion, first and second side portions respectively connected to opposing ends of said top portion of said opening window, and a keeper connected to and projecting downward from said top portion, said keeper being disposed closer to said first side portion than to said second side portion of said opening window;

a closing window comprising a top portion, and first and second side portions respectively connected to opposing ends of said top portion of said closing window, said closing window being separated from said opening window by a central connecting zone;

a first ridge located in said central zone proximal to said opening window and comprising a first convex surface of curving form; and

a second ridge located in said central zone proximal to said opening window, said second ridge being generally opposed to said first ridge and comprising a second convex surface of curving form,

wherein each of said first and second convex surfaces of curving form has a shape designed to cam the profiles of a zipper toward each other and toward said top portion of said opening window when the zipper is being opened by said slider.

11. The slider as recited in claim **10**, further comprising first and second tabs located in said central zone and generally opposed to each other, said first tab being generally disposed between said first side portions of said opening

and closing windows, and said second tab being generally disposed between said second side portions of said opening and closing windows.

12. The slider as recited in claim **11**, wherein a base of said first ridge is connected to said first tab and a base of said second ridge is connected to said second tab.

13. The slider as recited in claim **11**, further comprising third and fourth tabs located in a first end zone separated from said central zone by said opening window and generally opposed to each other, and fifth and sixth tabs located in a second end zone separated from said central zone by said closing window and generally opposed to each other.

14. A slider for opening and closing a plastic zipper of the type having a fulcrum, comprising:

first and second side walls separated by space occupied in part by the zipper;

a first beam having one end connected to said first side wall and the other end connected to said second side wall, said first beam and respective first portions of said first and second side walls adjoining said first beam defining an opening window;

a second beam having one end connected to said first side wall and the other end connected to said second side wall, said second beam and respective second portions of said first and second side walls adjoining said second beam defining a closing window;

first and second tabs respectively projecting from said first and second side walls and toward each ocher for retaining the slider on the zipper; and

a first ridge projecting from said first side wall proximal to said opening window and comprising a first convex surface of curving form,

wherein said first convex surface of curving form is tapered upward.

15. The slider as recited in claim **14**, wherein said first beam comprises a downwardly projecting keeper.

16. The slider as recited in claim **14**, wherein said first and second side walls, said first and second beams, said first and second tabs and said first ridge are integrally formed as parts of a monolithic molded body.

17. A slider for opening and closing a plastic zipper of the type having a fulcrum, comprising:

first and second side walls separated by space occupied in part by the zipper;

a first beam having one end connected to said first side wall and the other end connected to said second side wall, said first beam and respective first portions of said first and second side walls adjoining said first beam defining an opening window;

a second beam having one end connected to said first side wall and the other end connected to said second side wall, said second beam and respective second portions of said first and second side walls adjoining said second beam defining a closing window;

first and second tabs respectively projecting from said first and second side walls and toward each other for retaining the slider on the zipper; and

a first ridge projecting from said first side wall proximal to said opening window and comprising a first convex surface of curving form,

wherein said first convex surface of curving form is generally conical.

18. The slider as recited in claim **17**, wherein said first beam comprises a downwardly projecting keeper.

19. The slider as recited in claim **17**, wherein said first and second side walls, said first and second beams, said first and second tabs and said first ridge are integrally formed as parts of a monolithic molded body.

20. A slider for opening and closing a plastic zipper of the type having a fulcrum, comprising:

first and second side walls separated by space occupied in part by the zipper;

a first beam having one end connected to said first side wall and the other end connected to said second side wall, said first beam and respective first portions of said first and second side walls adjoining said first beam defining an opening window;

a second beam having one end connected to said first side wall and the other end connected to said second side wall, said second beam and respective second portions of said first and second side walls adjoining said second beam defining a closing window;

first and second tabs respectively projecting from said first and second side walls and toward each other for retaining the slider on the zipper; and

a first ridge projecting from said first side wall proximal to said opening window and comprising a first convex surface of curving form; and

a second ridge projecting from said second side wall proximal to said opening window and in opposition to said first ridge, wherein said second ridge comprises a second convex surface of curving form,

wherein each of said first and second convex surfaces of curving form has a respective shape designed to cam the profiles of a zipper toward each other and toward said first beam when said the zipper is being opened by said slider.

21. The slider as recited in claim **20**, wherein said first ridge extends generally transverse to said first tab and said second ridge extends generally transverse to said second tab.

22. A slider for use on a zipper of the type comprising a first profiled interlockable member and a second profiled interlockable member adapted to interlock with said first interlockable member, said slider comprising:

a pair of spaced apart arms defining at opposite ends of said arms a zipper opening end of said slider that disengages adjoining first portions of said first and second interlockable members and a zipper closing end of said slider that interlocks adjoining second portions of said first and second interlockable members;

bridge means that span a gap between said arms, said bridge means being connected to top portions of said arms;

means for keeping said first portion of said first interlockable member at least partially disengaged from said first portion of second interlockable member in said zipper opening end;

means for camrning said first portion of said first interlockable member toward said keeping means when said slider is moved in a zipper opening direction; and

means for retaining said slider on said zipper.

23. The slider as recited in claim **22**, wherein said camming means is located between said zipper closing end and said zipper opening end, and is closer to said zipper opening end than to said zipper closing end.

24. The slider as recited in claim **23**, wherein said camming means comprise a ridge having a generally conical surface.

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